

Amendments to the Claims

The Claim Listing below replaces all prior versions of the claims in the subject application.

Claim Listing:

Claim 1 (previously presented): A method, comprising:

providing a source map indicating blocks of data striped across a first plurality of storage units and a destination map indicating blocks of data striped across a second plurality of storage units, wherein data is migrated from stripes indicated in the source map to corresponding stripes indicated in the destination map; and

for each of a plurality of source stripes to copy to corresponding destination stripes, separately performing, in response to determining that the source stripe and the destination stripe occupy a same physical location on the storage units, writing the data from a source stripe to a copy area and writing the data from the copy area to a corresponding destination stripe.

Claim 2 (previously presented): The method of claim 1, further comprising:

determining units of operation, wherein one unit of operation comprises one stripe indicated in the source map to migrate to one stripe indicated in the second map,

wherein the data is migrated by processing the units of operation.

Claim 3 (original): The method of claim 2, further comprising:

locking data in one source stripe in one unit of operation currently being migrated; and

unlocking the locked data after completing the migration of the source data in the unit of operation.

Claim 4 (original): The method of claim 2, further comprising:

indicating a number of a current unit of operation being processed; and

indicating data is being copied through the copy area in response to determining that the source stripe and destination stripe involved in the current unit of operation occupy the same physical locations.

Claim 5 (original): The method of claim 4, further comprising:

incrementing the current unit of operation in response to completing copying the source stripe to the destination stripe for one unit of operation; and

indicating data is not being copied through the copy area in response to completing copying the source stripe to the destination stripe for one unit of operation.

Claim 6 (original): The method of claim 4, further comprising:

determining whether data is indicated as being copied through the copy area after recovering from a failure;

writing the data from the copy area to the destination stripe in the indicated current unit of operation in response to determining that the data is indicated as being copied through the copy area; and

continuing processing the units of operation to complete the migration of the source stripes to the destination stripes.

Claim 7 (original): The method of claim 1, further comprising:

determining a depth of a source volume including the source stripes and a depth of a destination volume including the destination the destination stripes;

writing the source stripes in descending order from one source stripe at a first physical location of the source volume to the destination stripes in response to determining that the destination volume depth exceeds the source volume depth; and

writing the source stripes in ascending order from one source stripe at a last physical location of the source volume to the destination stripes in response to determining that the destination volume depth does not exceed the source volume depth.

Claim 8 (previously presented): The method of claim 1, further comprising:

determining whether an overlap comprising the source stripe and the destination stripe occupying the same physical location is permissible; and

aborting the migration in response to determining that the overlap is impermissible.

Claim 9 (previously presented): The method of claim 8, wherein determining whether the overlap is impermissible comprises:

determining a depth of a source volume including the source stripes and a depth of a destination volume including the destination stripes;

determining a source physical location on one storage unit of a first block in a first stripe in the destination volume and a destination physical location on one storage unit of a first block in a first stripe in the source volume; and

determining that the migration is impermissible in response to determining: (1) that the destination volume depth is less than or equal to the source volume depth and the destination physical location is greater than the source physical location or (2) that the destination volume depth is greater than the source volume depth and the destination physical location is less than the source physical location.

Claim 10 (original): The method of claim 1, wherein a number of the first plurality of storage units is different than a number of the second plurality of storage units.

Claim 11 (original): The method of claim 1, further comprising:

detecting a failure of one of the first plurality of storage units;

rebuilding data from the failed storage units using parity data on the first plurality of storage units that did not fail, wherein the migration is performed to transfer the rebuilt data and the data in the first plurality of storage units that did not fail to the second plurality of storage units including the storage units of the first plurality that survived.

Claim 12 (original): The method of claim 1, wherein the storage units comprise magnetic hard disk drives and wherein a Redundant Array of Independent Disk (RAID) algorithm is used to stripe the data to the disks.

Claim 13 (currently amended): A system in communication with a plurality of storage units, comprising:

a source map indicating blocks of data striped across a first plurality of storage units;

a destination map indicating blocks of data striped across a second plurality of storage units; and

circuitry comprising a storage controller, the circuitry being operable to:

migrate data from stripes indicated in the source map to corresponding stripes indicated in the destination map; and

for each of a plurality of source stripes to copy to corresponding destination stripes, separately performing, in response to determining that the source stripe and the destination stripe occupy a same physical location on the storage units, write the data from a source stripe to a copy area and writing the data from the copy area to a corresponding destination stripe.

Claim 14 (previously presented): The system of claim 13, wherein the circuitry is further operable to:

determine units of operation, wherein one unit of operation comprises one stripe indicated in the source map to migrate to one stripe indicated in the second map, wherein the data is migrated by processing the units of operation.

Claim 15 (original): The system of claim 14, wherein the circuitry is further operable to:

lock data in one source stripe in one unit of operation currently being migrated;
and

unlock the locked data after completing the migration of the source data in the
unit of operation.

Claim 16 (original): The system of claim 13, wherein the circuitry is further operable
to:

indicate a number of a current unit of operation being processed; and

indicate data is being copied through the copy area in response to determining
that the source stripe and destination stripe involved in the current unit of operation
occupy the same physical locations.

Claim 17 (original): The system of claim 16, wherein the circuitry is further operable to:

increment the current unit of operation in response to completing copying the
source stripe to the destination stripe for one unit of operation; and

indicate data is not being copied through the copy area in response to
completing copying the source stripe to the destination stripe for one unit of operation.

Claim 18 (original): The system of claim 16, wherein the circuitry is further operable to:

determine whether data is indicated as being copied through the copy area after recovering from a failure;

write the data from the copy area to the destination stripe in the indicated current unit of operation in response to determining that the data is indicated as being copied through the copy area; and

continue processing the units of operation to complete the migration of the source stripes to the destination stripes.

Claim 19 (original): The system of claim 13, wherein the circuitry is further operable to:

determine a depth of a source volume including the source stripes and a depth of a destination volume including the destination the destination stripes;

write the source stripes in descending order from one source stripe at a first physical location of the source volume to the destination stripes in response to determining that the destination volume depth exceeds the source volume depth; and

write the source stripes in ascending order from one source stripe at a last physical location of the source volume to the destination stripes in response to determining that the destination volume depth does not exceed the source volume depth.

Claim 20 (previously presented): The system of claim 13, wherein the circuitry is further operable to:

determine whether an overlap comprising the source stripe and the destination stripe occupying the same physical location is impermissible; and

abort the migration in response to determining that the overlap is impermissible.

Claim 21 (currently amended): The system of claim 20, wherein determining whether the overlap is impermissible comprises:

~~determining~~ ~~determine~~ a depth of a source volume including the source stripes and a depth of a destination volume including the destination stripes;

~~determining~~ ~~determine~~ a source physical location on one storage unit of a first block in a first stripe in the destination volume and a destination physical location on one storage unit of a first block in a first stripe in the source volume; and

~~determining~~ ~~determine~~ that the migration is impermissible in response to determining: (1) that the destination volume depth is less than or equal to the source volume depth and the destination physical location is greater than the source physical location or (2) that the destination volume depth is greater than the source volume depth and the destination physical location is less than the source physical location.

Claim 22 (original): The system of claim 13, wherein a number of the first plurality of storage units is different than a number of the second plurality of storage units.

Claim 23 (original): The system of claim 13, wherein the circuitry is further operable to:

detect a failure of one of the first plurality of storage units;

rebuild data from the failed storage units using parity data on the first plurality of storage units that did not fail, wherein the migration is performed to transfer the rebuilt data and the data in the first plurality of storage units that did not fail to the second plurality of storage units including the storage units of the first plurality that survived.

Claim 24 (previously presented): A system, comprising:

a plurality of storage units;

a source map indicating blocks of data striped across a first plurality of storage units;

a destination map indicating blocks of data striped across a second plurality of storage units; and

circuitry operable to:

migrate data from stripes indicated in the source map to corresponding stripes indicated in the destination map; and

for each of a plurality of source stripes to copy to corresponding destination stripes, separately performing, in response to determining that the source stripe and the destination stripe occupy a same physical location on the storage units, write the data from a source stripe to a copy area and writing the data from the copy area to a corresponding destination stripe.

Claim 25 (original): The system of claim 24, wherein the circuitry is further operable to:

indicate a number of a current unit of operation being processed; and

indicate data is being copied through the copy area in response to determining that the source stripe and destination stripe involved in the current unit of operation occupy the same physical locations.

Claim 26 (original): The system of claim 24, wherein the storage units comprise magnetic hard disk drives and wherein a Redundant Array of Independent Disk (RAID) algorithm is used to stripe the data to the disks.

Claim 27 (previously presented): An article of manufacture comprising at least one of processor executable code in a computer readable medium and logic implemented in a hardware device capable of causing operations, the operations operable to:

provide a source map indicating blocks of data striped across a first plurality of storage units and a destination map indicating blocks of data striped across a second plurality of storage units, wherein data is migrated from stripes indicated in the source map to corresponding stripes indicated in the destination map; and

for each of a plurality of source stripes to copy to corresponding destination stripes, separately performing, in response to determining that the source stripe and the destination stripe occupy a same physical location on the storage units, write the data from a source stripe to a copy area and writing the data from the copy area to a corresponding destination stripe.

Claim 28 (previously presented): The article of manufacture of claim 27, wherein the operations are further operable to:

determine units of operation, wherein one unit of operation comprises one stripe indicated in the source map to migrate to one stripe indicated in the second map, wherein the data is migrated by processing the units of operation.

Claim 29 (original): The article of manufacture of claim 28, wherein the operations are further operable to:

lock data in one source stripe in one unit of operation currently being migrated;
and

unlock the locked data after completing the migration of the source data in the unit of operation.

Claim 30 (original): The article of manufacture of claim 28, wherein the operations are further operable to:

indicate a number of a current unit of operation being processed; and

indicate data is being copied through the copy area in response to determining that the source stripe and destination stripe involved in the current unit of operation occupy the same physical locations.

Claim 31 (previously presented): The article of manufacture of claim 30, wherein the operations are further operable to:

increment the current unit of operation in response to completing copying the source stripe to the destination stripe for one unit of operation; and

indicate data is not being copied through the copy area in response to completing copying the source stripe to the destination stripe for one unit of operation.

Claim 32 (original): The article of manufacture of claim 30, wherein the operations are further operable to:

determine whether data is indicated as being copied through the copy area after recovering from a failure;

write the data from the copy area to the destination stripe in the indicated current unit of operation in response to determining that the data is indicated as being copied through the copy area; and

continue processing the units of operation to complete the migration of the source stripes to the destination stripes.

Claim 33 (original): The article of manufacture of claim 27, wherein the operations are further operable to:

determine a depth of a source volume including the source stripes and a depth of a destination volume including the destination the destination stripes;

write the source stripes in descending order from one source stripe at a first physical location of the source volume to the destination stripes in response to determining that the destination volume depth exceeds the source volume depth; and

write the source stripes in ascending order from one source stripe at a last physical location of the source volume to the destination stripes in response to determining that the destination volume depth does not exceed the source volume depth.

Claim 34 (previously presented): The article of manufacture of claim 27, wherein the operations are further operable to:

determine whether an overlap comprising the source stripe and the destination stripe occupying the same physical location is impermissible; and

abort the migration in response to determining that the overlap is impermissible.

Claim 35 (currently amended): The article of manufacture of claim 34, wherein determining whether the overlap is impermissible comprises:

determining ~~determine~~ a depth of a source volume including the source stripes and a depth of a destination volume including the destination stripes;

determining ~~determine~~ a source physical location on one storage unit of a first block in a first stripe in the destination volume and a destination physical location on one storage unit of a first block in a first stripe in the source volume; and

determining ~~determine~~ that the migration is impermissible in response to determining: (1) that the destination volume depth is less than or equal to the source volume depth and the destination physical location is greater than the source physical location or (2) that the destination volume depth is greater than the source volume depth and the destination physical location is less than the source physical location.

Claim 36 (original): The article of manufacture of claim 27, wherein a number of the first plurality of storage units is different than a number of the second plurality of storage units.

Claim 37 (original): The article of manufacture of claim 27, wherein the operations are further operable to:

detect a failure of one of the first plurality of storage units;

rebuild data from the failed storage units using parity data on the first plurality of storage units that did not fail, wherein the migration is performed to transfer the rebuilt data and the data in the first plurality of storage units that did not fail to the second plurality of storage units including the storage units of the first plurality that

survived.

Claim 38 (original): The article of manufacture of claim 27, wherein the storage units comprise magnetic hard disk drives and wherein a Redundant Array of Independent Disk (RAID) algorithm is used to stripe the data to the disks.

Claim 39 (previously presented): The method of claim 1, further comprising:

copying the source stripe directly to the destination stripe in response to determining that the source stripe and the destination stripe do not occupy the same physical location on the storage units.

Claim 40 (previously presented): The system of claim 13, wherein the circuitry is further operable to:

copy the source stripe directly to the destination stripe in response to determining that the source stripe and the destination stripe do not occupy the same physical location on the storage units.

Claim 41 (previously presented): The system of claim 24, wherein the circuitry is further operable to:

copy the source stripe directly to the destination stripe in response to determining that the source stripe and the destination stripe do not occupy the same physical location on the storage units.

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Claim 42 (previously presented): The article of manufacture of claim 27, wherein the operations are further operable to:

copy the source stripe directly to the destination stripe in response to determining that the source stripe and the destination stripe do not occupy the same physical location on the storage units.